

A
ORIGINAL CLAIMS

1. A method for severing a brittle material substrate by scribing, comprising:

a first scribing step of performing scribing in a state in which a protective material is provided on at least one substrate surface of the brittle material substrate, using a cutter wheel with grooves formed in a ridge of the cutter wheel.

2. The method for severing a brittle material substrate according to claim 1, further comprising a protective material processing step of providing a protective material on at least one substrate surface of the brittle material substrate, before the scribing.

3. The method for severing a brittle material substrate according to claim 1 or 2, wherein the brittle substrate is a single-plate brittle material substrate.

4. The method for severing a brittle material substrate according to claim 3, further comprising a breaking step of breaking the brittle material substrate, after the scribing.

5. The method for severing a brittle material substrate according to claim 4, further comprising a protective material cutting step of cutting the protective material, after the breaking.

6. The method for severing a brittle material substrate according to claim 3, further comprising a protective material cutting step of cutting the protective material, after the scribing.

7. The method for severing a brittle material substrate according to claim 3, further comprising a first film processing step of applying a first protective film on a first substrate surface that has been scribed, after the scribing and before breaking the brittle material substrate.

8. The method for severing a brittle material substrate according to claim 3 or 7, further comprising a second film processing step of applying a second protective film on a second substrate surface that is different from the first substrate surface that is to be scribed, before the scribing.

9. The method for severing a brittle material substrate according to claim 7 or 8, further comprising a breaking step of breaking the brittle material substrate, after applying the first film.

10. The method for severing a brittle material substrate according to claim

9, further comprising a third film processing step of peeling off the second protective film, after the breaking.

11. The method for severing a brittle material substrate according to claim 8 or 10, further comprising a protective material cutting step of cutting the protective material and/or the protective film provided on the second substrate surface.

12. The method for severing a brittle material substrate according to claim 1 or 2, wherein the brittle material substrate is a bonded brittle material substrate formed by bonding together a first substrate and a second substrate.

13. The method for severing a brittle material substrate according to claim 12, further comprising a second scribing step of performing scribing in a state in which a protective material is provided on a surface of at least one of the first substrate and the second substrate, using a cutter wheel with grooves formed in a ridge of the cutter wheel, after scribing the first substrate in the first scribing step.

14. The method for severing a brittle material substrate according to claim 13, further comprising a first breaking step of breaking the first substrate, after scribing the first substrate in the first scribing step.

15. The method for severing a brittle material substrate according to claim 13 or 14, further comprising a second breaking step of breaking the second substrate, after scribing the second substrate in the second scribing step.

16. The method for severing a brittle material substrate according to any of claims 13 to 15, further comprising: a first film processing step of applying a first protective film on the second substrate, before scribing the first substrate in the first scribing step; and a second film processing step of peeling off the first protective film from the second substrate, before scribing the second substrate in the second scribing step.

17. The method for severing a brittle material substrate according to claim 15 or 16, further comprising a second film processing step of applying a second protective film on the second substrate, after scribing the second substrate in the second scribing step and before breaking the scribed second substrate in the second breaking step.

18. The method for severing a brittle material substrate according to claim 15 or 16, further comprising a third film processing step of applying a third protective film on the first substrate, after scribing the first substrate in the first scribing step and before breaking the first substrate in the first breaking step.

19. The method for severing a brittle material substrate according to claim

1 or 2, wherein the brittle material substrate is a brittle material substrate provided with a functional layer.

20. The method for severing a brittle material substrate according to claim 19, further comprising a breaking step of breaking the brittle material substrate provided with the functional layer, after the scribing in the first scribing step.

21. The method for severing a brittle material substrate according to claim 20, further comprising a protective material cutting step of cutting the protective material, after breaking the brittle material substrate provided with the functional layer in the breaking step.

22. The method for severing a brittle material substrate according to claim 19, further comprising: a first film processing step of applying a first protective film on a surface of the brittle material substrate provided with the functional layer that is different from a surface on which the functional layer is provided, before the scribing in the first scribing step; and a protective material cutting step of cutting the protective material and/or the first protective film.

23. The method for severing a brittle material substrate according to claim 22, further comprising a breaking step of breaking the brittle material substrate provided with the functional layer, after the scribing in the first scribing step.

24. The method for severing a brittle material substrate according to claim 23, further comprising: a second film processing step of applying a second protective film on that surface of the brittle material substrate provided with the functional layer on which the functional layer is provided, after the scribing in the first scribing step and before breaking the brittle material substrate provided with the functional layer in the breaking step; and a third film processing step of peeling off the second protective film, after breaking the brittle material substrate provided with the functional layer in the breaking step.

25. The method for severing a brittle material substrate according to any of claims 19 to 24, wherein the functional layer is a protective material also having a function to protect the brittle material substrate.

26. The method for severing a brittle material substrate according to any of claims 1 to 24, wherein the protective material provided on a surface of the brittle material substrate is a film.

27. The method for severing a brittle material substrate according to any of claims 1 to 24, wherein the protective material provided on a surface of the brittle material substrate is a coating.

28. A severing apparatus for a brittle material substrate that severs a brittle material substrate by scribing, comprising:

a first scribing device that performs scribing in a state in which a protective material is applied on at least one substrate surface of the brittle material substrate, using a cutter wheel with grooves formed in a ridge of the cutter wheel.

29. The severing apparatus for a brittle material substrate according to claim 28, further comprising a protective material processing device that applies the protective material on at least one substrate surface of the brittle material substrate.

30. The severing apparatus for a brittle material substrate according to claim 28 or 29, wherein the brittle substrate is a single-plate brittle material substrate.

31. The severing apparatus for a brittle material substrate according to claim 30, further comprising a breaking step of breaking the brittle material substrate.

32. The severing apparatus for a brittle material substrate according to claim 31, further comprising a protective material cutting device that cuts the protective material.

33. The severing apparatus for a brittle material substrate according to claim 30, further comprising a protective material cutting device that cuts the protective material.

34. The severing apparatus for a brittle material substrate according to claim 30, further comprising a first film processing device that applies a first protective film on a first substrate surface that is to be scribed.

35. The severing apparatus for a brittle material substrate according to claim 30 or 34, further comprising a second film processing device that applies a second protective film on a second substrate surface that is different from the first substrate surface.

36. The severing apparatus for a brittle material substrate according to claim 34 or 35, further comprising a breaking device that breaks the brittle material substrate.

37. The severing apparatus for a brittle material substrate according to claim 35, further comprising a third film processing device that peels off the second protective film.

38. The severing apparatus for a brittle material substrate according to

claim 35 or 37, further comprising a protective material cutting device that cuts the protective material and/or the protective film provided on the second substrate surface.

39. The severing apparatus for a brittle material substrate according to claim 28 or 29, wherein the brittle material substrate is a bonded brittle material substrate formed by bonding together a first substrate and a second substrate.

40. The severing apparatus for a brittle material substrate according to claim 39, further comprising a second scribing device that performs scribing in a state in which a protective material is provided on a surface of at least one of the first substrate and the second substrate, using a cutter wheel with grooves formed in a ridge of the cutter wheel, after scribing the first substrate in the first scribing step.

41. The severing apparatus for a brittle material substrate according to claim 40, further comprising a first breaking device that breaks the first substrate.

42. The severing apparatus for a brittle material substrate according to claim 40 or 41, further comprising a second breaking device that breaks the second substrate.

43. The severing apparatus for a brittle material substrate according to any of claims 40 to 42, further comprising: a first film processing device that applies a first protective film on the second substrate; and a second film processing device that peels off the first protective film from the second substrate.

44. The severing apparatus for a brittle material substrate according to claim 42 or 43, further comprising a second film processing device that applies a second protective film on the second substrate.

45. The severing apparatus for a brittle material substrate according to claim 42 or 43, further comprising a third film processing device that applies a third protective film on the first substrate.

46. The severing apparatus for a brittle material substrate according to claim 28 or 29, wherein the brittle material substrate is a brittle material substrate provided with a functional layer.

47. The severing apparatus for a brittle material substrate according to claim 46, further comprising a breaking device that breaks the brittle material substrate provided with the functional layer.

48. The severing apparatus for a brittle material substrate according to

claim 47, further comprising a protective material cutting device that cuts the protective material.

49. The severing apparatus for a brittle material substrate according to claim 46, further comprising: a first film processing device that applies a first protective film on a surface of the brittle material substrate provided with the functional layer that is different from a surface on which the functional layer is provided; and a protective material cutting device that cuts the protective material and/or the first protective film.

50. The severing apparatus for a brittle material substrate according to claim 49, further comprising a breaking device that breaks the brittle material substrate provided with the functional layer.

51. The severing apparatus for a brittle material substrate according to claim 50, further comprising: a second film processing device that applies a second protective film on that surface of the brittle material substrate provided with the functional layer on which the functional layer is provided; and a third film processing device that peels off the second protective film.

52. The severing apparatus for a brittle material substrate according to any of claims 46 to 51, wherein the functional layer is a protective material also having a function to protect the brittle material substrate.

53. The severing apparatus for a brittle material substrate according to any of claims 28 to 51, wherein the protective material provided on the surface of brittle material substrate is a film.

54. The severing apparatus for a brittle material substrate according to any of claims 28 to 51, wherein the protective material provided on the surface of brittle material substrate is a coating.